Forensic Entomology – Using "Corpses" to Learn about Succession

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Grade: High School

Observations:

Many insects process dead animal remains and often use decomposing animal remains as a key stage in development. Succession is a predictable order of invasion and colonization by organisms. Forensic entomologists often use theories of succession and information regarding colonizers to determine various facts about a discovered corpse/body. For example, knowing the time interval of certain larval stages and the order of insect invasion can give investigators a general idea of the time and location of death.

Question:

What insects will first colonize a slab of steak? What is the order of succession of insects after the initial invasion of primary colonizers?

Hints to form the hypothesis:

"What are some things you know about succession already?"
"Is succession predictable?"
"Why aren't late insect colonizers able to colonize animal remains early? i.e., Why are late insect colonizers late, and early colonizers early?"

Hypothesis:

By placing steak (animal remains) in a certain area and recording the succession/colonization of certain insects at certain times, the approximate time of death (period in which steak is first laid out) of a steak, set out for an unknown period of time, can be determined.

Materials:

- Several large slabs of steak or other meat,
- Bug nets
- Bug box or shoe box (to view captured insects)
- Insect pins (to pin representative insects to display)
- Thermometer
- Killing jars w/ 75% alcohol
- Plastic bags
- Freezer
- Figital camera (to take pictures)

Experiment:

1. Go to the experimental area (easily accessible cordoned off grassy area, field, etc.) and collect insects in the general area.

2. Identify insects and keep in bug container to view.

3. Set out several steak pieces.

4. Return to experimental area two to three times a week. Capture insects around steak pieces and identify insects.

5. Pin insects inside bug box/shoe box, and be sure to label the insects with the date and age of the meat.

6. After a predetermined amount of time, the experiment will end (perhaps 2 – 6 weeks or 6 – 24 collection periods?)

7. At the conclusion of the experiment, the student should have a pinned collection of insects sampled from the meat at different succession periods. It should be apparent that the populations of colonizing/occupying insects change over time.

Note: all collected insects should be killed in either killing jars, or frozen in freezers.

Note: It would be preferable if students were able to take ambient temperature, and temperature of the steak pieces, as well as the temperature of the ground, but it is not essential to the project.

Result:

Keep data in excel chart, see sample attached.

Discussion:

This project is best suited for a student who already has some experience identifying insects, and has covered at least a little material regarding succession. In essence, the class will create a baseline dataset in which to draw inferences from. The class data set (type of insect, stage, approx. frequency of insect) will be used to determine when the teacher's "mystery-time-of-death" steak pieces occurred. If the teacher wishes, he/she could "cut corners" to save time and either 1) set out mystery steak pieces ahead of time (flaw: environmental conditions might not be the same) or 2) simply make up a corpse with fictional insects and have the students determine the time of death (flaw: the experience is not as unique).

Common brown blow fly, hairy maggot blow fly, green bottle fly, and wood gnats, are some of the expected colonizers. Describe succession in terms of a buffet table; in essence, a decomposing body provides a buffet for insects, but the line is only open to certain insects at certain times. When collecting insects, it is important to keep all of the insects from a particular

collecting period together. Otherwise, it would be difficult to determine the order of succession of insects onto the remains. Students should work in groups of four, and every group should have a steak piece.

Peterson's Field Guide to Insects is a helpful book to have in identifying insects. If the teacher and the students are not able to identify a particular insect, you can still get the needed effect by comparing the unknown insects to equally unknown look-a-like insects found in the students' baseline data; the most important thing being that the students have the general time of colonization of aforementioned unknown insect species. If a student has difficulty identifying insects, they should bring in the collected insects for extension entomologists to identify.

Estimated time required: 2 – 6 weeks

References:

http://www.forensicentomology.com/index.html
I highly recommend this website to learn more about forensic entomology. The author of the website is Dr. Byrd, and he provides many useful links and information for teachers and students.

I also suggest purchasing:

- Peterson's Field Guide to Insects
- Forensic Insect Identification Cards by James Castner and Jason Byrd

Contact:

For help or questions concerning this project, please contact the author- Alexander Ko at Alex ko.e.alexander@gmail.com